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Abstract

This comment concerns the article by Lewis et al. (2019). We do not question the detail of the Happisburgh site sequence, but the stratigraphical significance, the regional correlations and the age of certain localities with which the Happisburgh 1 sequence is equated by these authors. In particular we question the correlation with sequences at Warren Hill and High Lodge in Suffolk since detailed research has demonstrated that they are neither the same age nor of the origin stated in the original article. We also question the correlation of disparate geological sequences on the basis of their artefactual contents; an approach long considered to be inappropriate.

Keywords	Interglacial, Glaciation, Skertchly Line, stratigraphy, Bytham river
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Suggested reviewers	Jan Zalasiewicz, Wil Roebroeks, mark bateman, Colin Whiteman, Jamie Woodward

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Dear Editor,

Human occupation of northern Europe in MIS 13: Happisburgh Site 1 (Norfolk, UK) and its European context: a response to Lewis *et al.* (2019).

We wish to submit a response to the recent article by Lewis *et al.* (2019) for publication in *Quaternary Science Reviews*.

The response speaks for itself but we have felt it necessary to respond in order to correct inaccurate statements in and omissions from the article. I confirm that all three authors have made equal contributions to the response and approved the final version of the manuscript.

In view of the controversial nature of the interpretations, we respectfully ask that the reviews are undertaken by independent persons who are not involved in the controversy. Persons involved in the controversy include: J. Rose, D. Bridgland, D. Maddy, R. Westaway and their co-workers. We would, however, like to suggest the following names of possible appropriate British reviewers who can offer an informed opinion: J. Zalasiewicz (Leicester), C. Whiteman (Brighton), A. Straw (Lincolnshire), M. Bateman (Sheffield) and J. Woodward (Manchester).

We await your judgement.

Thank you in advance,

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Human occupation of northern Europe in MIS 13: Happisburgh Site 1 (Norfolk, UK) and its European context: a response to Lewis *et al.* (2019).

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Abstract: This comment concerns the article by Lewis *et al.* (2019). We do not question the detail of the Happisburgh site sequence, but the stratigraphical significance, the regional correlations and the age of certain localities with which the Happisburgh 1 sequence is equated by these authors. In particular we question the correlation with sequences at Warren Hill and High Lodge in Suffolk since detailed research has demonstrated that they are neither the same age nor of the origin stated in the original article. We also question the correlation of disparate geological sequences on the basis of their artefactual contents; an approach long considered to be inappropriate.

Keywords: Interglacial, Glaciation, Skerterchly Line, stratigraphy, Bytham river.

In their recent article, Lewis *et al.* (2019) report the results of an investigation of the succession exposed on the foreshore beneath the cliff sections at Happisburgh, Norfolk. Here a series of sediments unconformably underlying the Middle Pleistocene Anglian-age glacial North Sea Drift Formation deposits have yielded Palaeolithic artefact assemblages which the authors describe and consider in the context of the British and European archaeological sequences. The implications of these discoveries for the peopling of northern Europe some 0.5 Ma ago are discussed.

As these authors state, the coastal exposures of Pleistocene deposits in northern and eastern East Anglia have been the focus of research for over two centuries, but in spite of repeated examinations, it is only recently that undisputed evidence of the presence of early humans has been discovered. Unquestionably these recent discoveries, carried out in great detail at the two important localities of Pakefield and Happisburgh (sites 1 and 3), are of considerable importance to the western European record. However, what is of concern here is not the detail of the individual site sequence, but the stratigraphical significance, the regional correlation and the age of certain localities with which the Happisburgh 1 sequence reported by Lewis *et al.* (2019) is equated.

In the article, there is a lack of understanding of the regional geological setting of the site at Happisburgh and of lithostratigraphical terminology. The correct term for the glacial

sequence overall is the North Sea Drift Formation (e.g. Gibbard & Clark, 2011), the basal member of which is the Happisburgh Diamicton (Lunkka 1994) and not the Happisburgh Formation as quoted by these authors. The underlying Cromer Forest-bed Formation (which the authors correctly apply), the unit that yields the anthropogenic evidence, is termed the Hill House Member (Gibbard 2011), a term omitted by the authors.

Whilst the authors offer no evidence for the age and equivalence of the glacial sequence at Happisburgh, it is important to emphasise that the North Sea Drift Formation deposits are of Anglian (Elsterian) age, and can be unequivocally correlated with the Marine Isotope Stage (MIS) 12 on the basis of the work presented by Toucanne *et al.* (2010). This interpretation is therefore that the Happisburgh Hill House Member and therefore its contained artefactual material must pre-date the glacial event, a fact not disputed here. The evidence for it actually representing the immediately pre-Anglian temperate event, i.e. Cromerian Complex Stage Interglacial IV, which has been equated to MIS 13, as the authors say, is not proven. All that can be said is that it is earlier in the Middle Pleistocene based on the biostratigraphy. The palaeomagnetism indicating a normal polarity indicates that the sediments must post-date the Brunhes-Matuyama palaeomagnetic reversal at 0.78 Ma (Head & Gibbard 2018).

Of particular concern is the concluding statement (p. 35) that the: “Happisburgh Site 1 is one of at least five sites in the UK (others include Boxgrove, High Lodge, Warren Hill and Waverley Wood) that date to this major turning point in the Lower Palaeolithic of Europe at 500 ka and contribute to the debate.” These sites are quoted without reference to the publications and to their site geology, their being suggested as equivalents based principally upon the apparent similarity of form in the artefacts they contain.

This train of thought is continued in the statement in section 7 (beginning on p.51): “The Happisburgh Site 1 has been attributed to MIS 13 on lithostratigraphic and biostratigraphic grounds and is one of several sites in Britain that date to this stage or to the start of MIS 12 (their fig. 12 and table 10)”. Although there is no question that the Happisburgh sequence (rather than the site) underlying the Happisburgh Member it must presumably pre-date the Anglian Stage glaciation (=MIS 12), no geological evidence is offered to support the correlation of the event recognised to a specific interval within the ‘Cromerian Complex’ Stage, e.g. MIS 13).

They continue “Comparisons can be made between the various lithic industries and inferred behavioural traits, and also between the types of human habitat represented at these sites, which include Warren Hill, High Lodge, Waverley Wood and Boxgrove” (p.51). Whilst similarities in the Palaeolithic artefact industries and assumed behavioural traits (however they can be determined) may occur between the potentially equivalent localities mentioned by these authors, independent geological support for these possible correlations goes unmentioned. Setting aside the likely equivalent of the lagoonal fill sequence at Boxgrove, near Chichester (Roberts & Parfitt 1999), the evidence for the age and correlation of the remaining sequences is controversial (Gibbard *et al.* 2009, 2016; West *et al.* 2014).

The authors particularly mention the Suffolk site at Three Hills (incorrectly referred to as Warren Hill by these authors: *cf.* West *et al.* 2014). They state “the assemblage from Warren Hill was collected rather than excavated and therefore provides more limited data about the technology, but it does contain important information about handaxe and other tool forms (Wymer, 1985; Bridgland *et al.*, 1995; Moncel *et al.*, 2015; Voinchet *et al.*, 2015). The assemblage was recovered from sands and gravels attributed to the lowest terrace of the Bytham River and dated to the end of MIS 13, or the beginning of MIS 12” (p.51). This statement is made without any reference to a series of articles published on the deposits which the present writers have demonstrated do not represent a fluvial terrace accumulation but glacial deposits of the Feltwell Formation (Gibbard *et al.* 2009, 2012a/b, 2018; West *et al.* 2017). Regarding the numerical ages obtained on sediment particles from this and neighbouring localities by Voinchet *et al.* (2015) using the Electron Spin Resonance method, it is clear that further analysis of the determinations is required since they conflict with the interpretation of the geology of the sequences.

Gibbard *et al.* (1992, 2009, 2012a/b, 2018) and West *et al.* (2017) have described evidence for late Middle Pleistocene glaciation in the Fenland Basin of East Anglia, England. Investigation of the setting, morphology and internal architecture of a line of hills adjacent to the south to eastern Fenland margin demonstrated that they represent glacio-marginal complexes. These accumulations mark a distinct glacial maximum limit, the Skerthly Line, and were formed where an ice lobe, flowing from the north or north-west, terminated at the basin margin. In so doing it dammed a series of streams draining into the Fenland to form proglacial lakes in contact with the ice front, including Lake Paterson. Meltwater discharges from portals in the ice margin formed a series of ice-contact delta and terminoglacial fans. That at Three Hills is at the southern end of this series of marginal sediments, together with similar artefact-bearing accumulations to the west at Barton Hill (Gibbard *et al.* 2009), Kentford (Wymer 1985) and Hare Park (West 2017).

Likewise the silts at the High Lodge site, which the authors note “lies 1 km to the north of Warren Hill and has two main assemblages. The lower non-handaxe assemblage was excavated from the alluvial clays of Bed C, which are attributed to floodplain sediments of the Bytham River during MIS 13 (Ashton *et al.*, 1992)” (p.51-52). In passing they note correctly that “an alternative interpretation” (p.52) was published by West *et al.* (2014), yet they fail to discuss the implications of that interpretation. As they will be aware the latter interpretation excludes the possibility of the High Lodge deposits being those of a ‘Bytham’ river, nor are the fine deposits alluvial in origin, rather they represent a pond accumulation in a doline. The authors have overlooked the fact that the silts (their Bed C) overlie, rather than underlie, Anglian-age Lowestoft Formation glacial diamicton and therefore can only be of post- rather than pre-Anglian age. Moreover, the entire existence of a ‘Bytham’ river in this area has been shown to be erroneous (Gibbard *et al.* 2013), the deposits on the eastern Fenland margin attributed to this river actually being of glacio-marginal origin, as stated above. This line of glaciofluvial landforms and the associated ice advance, the Tottenhill advance, has been demonstrated to be of Late Wolstonian age (i.e. Late Saalian, broadly early Marine Isotope Stage (MIS) 6). This age is confirmed by multiple lines of evidence including both published and unpublished

numerical, Optical Spin Resonance dating, i.e. intermediate between the Hoxnian (Holsteinian; c. MIS 11c; cf. Ashton *et al.* 2008) and Ipswichian (Eemian; c. MIS 5e) interglacial stages (Clark *et al.* 2004; Gibbard *et al.* 1991, 1992, 2009, 2012a; Lewis & Rose 1991; Gibbard & Clark 2011).

Unfortunately, Lewis *et al.* (2019) have not only attempted to correlate disparate geological sequences on the basis of their artefactual contents; an approach long considered to be inappropriate by both Wymer (1968, p. 365-6) and Roe (1981, p.11), but they have also apparently ignored the substantial body of evidence for the age of the Fenland sequences, whilst continuing to propagate the failed concept of a 'Bytham' river on the margin of Fenland. In doing so, they have not sufficiently realised the primacy of geology in independently determining the succession of Palaeolithic industries.

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